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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/050,195	01/16/2002	Sang-Bom Kang	5649-912	6301

20792 7590 02/28/2003

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EXAMINER

IM, JUNGHWA M

ART UNIT PAPER NUMBER

2811

DATE MAILED: 02/28/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.		Applicant(s)	
	10/050,195		KANG ET AL.	
	Examiner		Art Unit	
	Junghwa M. Im		2811	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 25 November 2002.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-44 is/are pending in the application.
- 4a) Of the above claim(s) 15-24 and 33-44 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-14 and 25-32 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s) _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s) <u>3</u> | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Election/Restrictions

Applicant's election without traverse of claims 1-14 and 25-32 in Paper No. 5 is acknowledged. And claims 15-24 and 33-44 have been canceled.

Claim Objections

Claims 3 and 28 are objected to because of the following informalities: "amorphorous" material can not have a crystal structure.

Appropriate correction is required.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 4-6, 12, 14 and 32 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 4 recites an ohmic layer disposed between the liner and the sidewalls of the insulator implying that the ohmic layer is formed on the sidewalls of the insulator. However, claim 1 recites that a liner is formed on the sidewalls of the insulator.

There is no antecedent basis in claim 12 for "the capacitor" and claim 32 for "the lower electrode of a capacitor".

Claim 14 recites an unspecified term "another location".

Claims 5 and 6 are dependant to the rejected base claim.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1, 3-5 and 7-10 are rejected under 35 U.S.C. 102(b) as being anticipated by Chang et al. (US 5,672,543), hereafter Chang.

Regarding claim 1, Figure 8 of Chang shows a semiconductor device comprising a substrate 10, an insulating layer 20 disposed on the substrate having a gap, a liner layer 26 that exhibits compressive stress (col. 1, lines 33-34) on the sidewalls of the insulating layer and on the substrate in the gap, and a contact plug 28 that exhibits tensile stress characteristics (col. 1, lines 53-54) on the liner layer.

Regarding claim 3, the liner of Chang inherently possesses an amorphous crystal structure since it is deposited by PVD.

Regarding claims 4 and 5, insofar as in compliance with 35 USC 112, Chang shows an ohmic layer, Ti.

Regarding claim 7, Chang discloses the thickness of the liner is 500 Angstroms.

Regarding claims 8-10, Figure 8 of Chang discloses an aluminum layer 44 (col.3, line 59).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over Chang in view of Taguwa (US 6,404,058).

Regarding claim 2, Chang discloses substantially the entire claimed device except the contact plug made of TiN. However, Taguwa discloses in Fig. 1B a TiN contact plug 505 exhibiting tensile stress (col. 3, line 39). It would have been obvious to one of ordinary skill in the art at the time of the invention to form a TiN plug in the device of Chang with Taguwa's teaching in order to reduced a production cost as taught in column 3, lines 57-64 of Taguwa.

Claim 6 is rejected under 35 U.S.C. 103(a) as being obvious over Chang.

Regarding claim 6, Chang does not explicitly disclose the thickness of the ohmic layer as claimed. However, it would have been obvious to one of ordinary skill in the art at the time of the invention to have an intended range of the thickness for an ohmic layer as in pending claim, since it would have been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only in routine skill in the art.

In re Aller, 105 USPQ 233.

Claims 11-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chang in view of Rhodes et al. (US 6,492,241), hereafter Rhodes.

Regarding claims 11-13, Chang discloses substantially the entire claimed device except a

capacitor structure on the contact plug. However, Rhodes shows in Fig.1 a capacitor 120 formed on a contact plug 108 and a capacitor with a lower electrode 114 (col. 1, lines 57-59) made of Pt (col.2, line 33). It would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate Rhodes' teaching to Chang's device in order to fabricate a DRAM array with a charge storage capacitor.

Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Chang in view of Nagasaka et al.(US 6,300,683), hereafter Nagasaka.

Regarding claim 14, insofar as in compliance with 35 USC 112, Chang discloses substantially the entire claimed device except a shape of the contact plug. However, Fig. 19D of Nagasaka shows a tapered contact plug 12 with a barrier metal 11 surrounded. It would have been obvious to one of ordinary skill in the art at the time of the invention to form a tapered contact plug of Chang with Nagasaka's teaching in order to have a finer surface interconnection.

Claims 25-29 and 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chang in view of Taguwa.

Regarding claim 25, Figure 8 of Chang discloses a contact plug formed through an insulating film 20 interposed between a lower conductive layer 24 and an upper conductive layer 44 to electrically connect the lower conductive layer to the upper conductive layer comprising a plug 28 having an upper surface contacting the upper conductive layer and having tensile stress (col. 1, lines 53-54), a TiN liner 26 surrounding the TiN plug and having compressive stress and an ohmic layer 24 contacting the TiN liner.

Chang discloses substantially the entire claimed device except a plug made of TiN.

~~However, Taguwa teaches a TiN plug in lieu of W plug of Chang. It would have been obvious~~

to one of ordinary skill in the art at the time of the invention to form a TiN plug in the device of Chang with Taguwa's teaching in order to reduced a production cost as taught in column 3, lines 57-64 of Taguwa.

Regarding claim 26, Taguwa discloses a TiN plug formed by CVD (col.2, lines 35-39).

Regarding claim 27, Chang discloses a TiN liner formed by CVD (col. 3, lines 13-14). In addition, CVD, ALD, CVD AND ALD are a process designation and would thus not carry patentable weight in this claim drawn to a product. See *In re Thorp*, 227 USPQ 964 (Fed. Cir. 1985).

Regarding claim 28, Chang discloses a TiN liner has an amorphous crystal structure since it is deposited by PVC.

Regarding claim 29, Chang discloses a TiN liner formed by physical vapor deposition (col. 3, line 13). In addition, IPVD is a process designation and would thus not carry patentable weight in this claim drawn to a product. See *In re Thorp*, 227 USPQ 964 (Fed. Cir. 1985).

Regarding claim 31, Chang discloses the upper conductive layer made of Al (col.3, line 59).

Claim 30 is rejected under 35 U.S.C. 103(a) as being unpatentable over Chang and Taguwa applied to claim 25 above, and further in view of Nagasaka.

Regarding claim 30, the teachings of Chang and Taguwa disclose most of the instant invention except a tapered contact plug. Nagasaka teaches a tapered contact plug 12 in Fig. 19D. The motivation to incorporate Nagasaka's teaching to the shape the contact plug of Chang and Taguwa has been stated above in claim 14.

Claim 32 is rejected under 35 U.S.C. 103(a) as being unpatentable over Chang and Taguwa applied to claim 25 above, and further in view of Rhodes.

Regarding claim 32, the teachings of Chang and Taguwa disclose most of the instant invention except the upper conductive layer comprising a lower electrode of a capacitor. Rhodes teaches a capacitor structure formed on top of the plug instead of a metal layer. The motivation to incorporate Rhodes' teaching of a capacitor structure to the upper conductive layer of Chang and Taguwa has been stated above in claim 11.

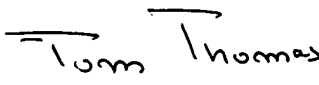
Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Junghwa M. Im whose telephone number is (703) 305-3998. The examiner can normally be reached on MON.-FRI. 8:30AM-5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Thomas can be reached on (703) 308-2772. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-7722 for regular communications and (703) 308-7724 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

jim
February 24, 2003


TOM THOMAS
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800